Claims

1. A Laser means for producing an essentially round or elliptical beam spot comprising a diode pumping array (1) with a plurality of emitters and optical means for producing an pump beam (7) by imaging each single emitter into the same spot (6), wherein the images of said emitters in said spot (6) form a smooth spot by an overlap of said images in a sense that if some of said emitters die or degrade said spot will not substantially change its intensity pattern.

2. A Laser means as in claim 1 wherein
   - at least two of the emitters, each emitting a partial beam, are mounted in a horizontal array and
   - said optical means collimate the vertical axis of said partial beam and
   - said optical means downstream
     - o collimate said partial beam in a horizontal plane and
     - o focuse said partial beam in the vertical plane and
     - o direct it to said spot.

3. A Laser means as in claim 1or 2 wherein said optical means comprises
   - a first cylindrical lens (2) for collimating the strongly divergent pump light of said partial beam which first cylindrical lens (2) is positioned nearby said emitters (1) at a distance corresponding to the focal length of the first cylindrical lens (2); and
   – a first lens (5) for collimating said partial beam in a horizontal plane and focusing said partial beam in the vertical plane and directing it to said spot, which first lens (5) is positioned at a distance away from the diode pumping array (1) corresponding to the focal length of the first lens (5).

4. A Laser means as in claim 1 wherein
   - at least two of the emitters, each emitting a partial beam, are mounted in a horizontal array and
   - said optical means collimate the vertical axis of said partial beam and
   - said optical means downstream
     - o collimate said partial beam in a horizontal plane and
     - o direct it to said spot.

5. A Laser means as in claim 4 wherein said optical means comprises
   - a first cylindrical lens (2) for collimating a strongly divergent emission of an emitter into a beam (7b) in a first plane, which first cylindrical lens (2) is positioned near the diode array (1a) at a distance corresponding to the focal length of the first cylindrical lens (2); and
   - a second cylindrical lens (16c) for collimating said beam (7b), which second cylindrical lens (16c) is positioned at a distance from the diode pumping array (1a) corresponding to the focal length of the second cylindrical lens (16c).

6. A laser means as in claim 5 wherein said second cylindrical lens (16c) collimates said beam (7b) into a collimated beam (7c) in a second plane perpendicular to the first plane.

7. A laser means as in claim 6 wherein said second cylindrical lens (16c) directs a plurality of said collimated beams (7c) to substantially a same spot (14).

8. A Laser means as in one of the preceding claims wherein said diode pumping array (1) is held by a diode array mount (3) and wherein said optical means comprises adjusting means (110) for adjusting the axis of the pump light beam (7) to a defined plane relative to the diode array mount (3), which adjusting means includes at least one wedged window (27, 127).

9. A Laser means as in claim 8, wherein
   - said diode array (1),
   - said diode array mount (3)
   - said first cylindrical lens (2) is positioned nearby the diode array (1), preferably at the diode array mount (3), and
   - said adjusting means (110)

   are fixed to a laser system base (28).

10. A Laser means as in claim 9 wherein said adjusting means (110) further comprises at least one parallel window.

11. A Laser means as in claim 10 further comprising a mounting frame (111) for holding said diode array mount (3) and said at least one parallel window wherein said mounting frame (111) has a contact plane for fixing said mounting frame (111) to said laser system base (28).

12. A Laser means as in claim 11 wherein said pumping device mounting frame (111) has a side wall with an opening at which said at least one parallel window is arranged.

13. A Laser means as in claim 11 or 12 wherein the pumping device mounting frame (111) comprises three horizontal positioning areas (115) and preferably three vertical positioning areas (116) for mounting diode array pumping device (103) at the laser system base (28) in a defined position.

14. A Laser means as claim 1 or 2 wherein said optical means comprises
– a second lens (16a) for collimating said partial beam in the vertical and in the horizontal plane and directing it to said spot, which second lens is positioned at a distance away from the diode pumping array corresponding to the focal length of the second lens;
- a second cylindrical lens (17) positioned at a distance away from the diode pumping array corresponding to the sum of the focal length of the second cylindrical lens and of twice the focal length of the second lens; and
– a focusing lens (18) for collimating said partial beam in a first plane and for focusing the pump light beam in a second plane perpendicular to the first plane.

15. A Laser means as in one of the preceding claims wherein said diode pumping array (1) comprises a laser diode bar (1c) generating said partial beams which are combined to a pump light beam (7).

16. A Laser means as in one of the preceding claims with an aspect ratio for the pump beam (7) of >15:1.

17. A diode-pumped Laser operating in the fundamental mode comprising
- a laser means according to one of the claims 1 through 12 and
- a solid state laser medium (4) which is excited by said laser means.

18. A diode-pumped Laser as in claim 17, characterized in that the cross-section of said elliptical beam spot has an aspect ratio of >3:1.

19. A diode-pumped Laser as in claim 17 or 18, characterized in that the thermal profile of the laser medium is smooth and enables fundamental mode laser operation.

20. A diode-pumped Laser as in claim 17, 18 or 19, wherein the laser mode is strongly elliptical within said laser medium (4).

21. A diode-pumped Laser as in claim 20 characterized in that the aspect ratio for the laser mode is >15:1.

22. A diode-pumped Laser as in one of the preceding claims 17 through 21 comprising cavity-forming means, whereby a reflective cavity element closest to an entrance face of said laser medium is not in direct contact with said entrance face.

23. A diode-pumped Laser as in one of the preceding claims 17 through 22, wherein the axis of said pump beam is positioned obliquely or even vertically to the axis of the laser mode.

24. A diode-pumped Laser as in any of claims 17 through 23, wherein said laser medium (4) comprises Nd:Vanadate.

25. A diode-pumped Laser as in one of the preceding claims 17 through 24 with a semiconductor saturable absorber (22) for obtaining a stable modelocked average output power of several Watts.

26. A diode-pumped Laser as in claim 25, where stable modelocked operation is obtained at a pulse energy density on the semiconductor saturable absorber (22) which is lower than 10 times the saturation energy density of said semiconductor saturable absorber (22).

27. A diode-pumped Laser as in claim 25 or 26, where stable modelocked operation is obtained at a pulse energy density on the semiconductor saturable absorber (22) which is lower than 0.5 mJ/cm^2.

28. A diode-pumped Laser with a laser means as in claim 4, 5, 6 or 7, comprising a single-pass or multi-pass amplifier or regenerative amplifier setup for generating micro-Joule- or milli-Joule-level laser pulse energies.

29. A solid state laser medium (4) excited by a laser means according to one of the claims 1 through 16 which is partly supported in at least two first regions (11a, 11b) contacting thermally conducting material (12), and with at least two second regions adjacent to said first regions (11a, 11b), the surface of said second regions contacting material (13) with low thermally conductivity.

30. A solid state laser medium (4) according to claim 29 wherein the contact to said thermally conducting material (12) is enhanced by a contacting medium.

31. A solid state laser medium (4) according to claim 30 wherein said contacting medium is indium or thermally conducting glue.

32. A solid state laser medium (4) according to claim 29, 30 or 31 wherein the heat flow from the laser medium (4) substantially has an one-dimensionality.

33. A diode array pumping device (103) for producing a pump light beam (7) for pumping a laser medium (4) fixed to a laser system base (28), comprising
- a diode array (1) for producing the pump light (7),
- a diode array mount (3) for holding said diode array (1),
- a collimation lens for collimating the pump light to the pump light beam (7) wherein said collimation lens is positioned nearby said diode array (1), preferably at the diode array mount (3), and
- adjusting means (110) for adjusting the axis of the pump light beam (7) to a defined plane relative to said diode array mount (3), which adjusting means (110) includes at least one wedged window (27, 127).

34. A diode array pumping device (103) as in claim 33 wherein said adjusting means (110) further comprises at least one parallel window.

35. A diode array pumping device (103) as in claim 33 or 34 further comprising a pumping device mounting frame (111) for holding said diode array mount (3) and said at least one window wherein said mounting frame (111) has a contact plane for fixing the diode array pumping device (103) to said laser system base (28).

36. A diode array pumping device (103) as in claim 35 wherein said pumping device mounting frame (111) has a side wall with an opening at which said at least one window is arranged.

37. A diode array pumping device (103) as in claim 35 or 36 wherein the pumping device mounting frame (111) comprises three horizontal positioning areas (115) and preferably three vertical positioning areas (116) for mounting diode array pumping device (103) at the laser system base (28) in a defined position.

38. A method for adjusting the axis of the pump light beam (7) of a diode array pumping device (103) as in claim 35 to a defined plane relative to a mount, comprising at least the steps of

- turning a wedged window (27, 127), through which the pump light beam (7) is passing, around its normal axis until the axis of the pump light beam (7) is in a plane parallel to the defined plane, and

– preferably fixing the wedged window (27, 127) to an holding part of the diode array pumping device (103).

39. A method as in claim 38 further comprising the steps of

- turning the wedged window (27, 127) or a parallel window around an axis aslant to the axis of the light beam (7) until the vertical offset of the beam axis is compensated and

- fixing this window to an holding part of the diode array pumping device (103).